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# Attachment A to Addendum 1

## REPORT OF GEOTECHNICAL EXPLORATION AND REVIEW

### Proposed New Building

75 MHR RTP Beds; VA Medical Center

G Street at 4<sup>th</sup> Street

Tomah, Wisconsin

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AET Project No. 12-01005

**Date:**

November 26, 2012

**Prepared for:**

Anderson Engineering of MN, LLC

13605 1<sup>st</sup> Avenue North, Suite 100

Plymouth, Minnesota 55441





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November 26, 2012

Mr. Peter Rauma, AIA  
Anderson Engineering of MN, LLC  
13605 1<sup>st</sup> Avenue North, Suite 100  
Plymouth, Minnesota 55441

RE: Report of Geotechnical Exploration and Review  
Proposed New Building  
75 MHR RTP Beds; VA Medical Center  
G Street at 4<sup>th</sup> Street  
Tomah, Wisconsin  
AET Project No. 12-01005

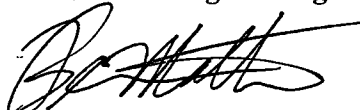
Dear Mr. Rauma:

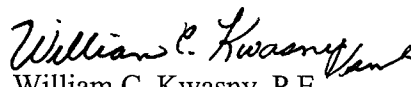
Following your acceptance of our proposal of September 7, 2012, we have completed the geotechnical exploration for your project. In this report we present the results of our field and laboratory testing, and our recommendations for earthwork and foundation design and construction. We are submitting three copies of this report to you; this report is the instrument of service defined in our proposal.

We have enjoyed working with you on this phase of the project. If you have questions regarding this report or if we can be of further assistance, please contact us.

Sincerely,

American Engineering Testing, Inc.

  
Benjamin B. Mattson, P.E.  
Geotechnical Engineer

  
William C. Kwasny, P.E.  
Principal Engineer

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**Signature Page**

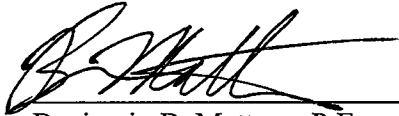
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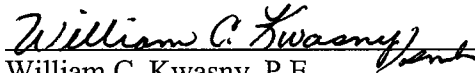
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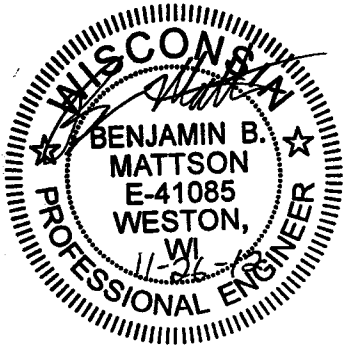


Benjamin B. Mattson, P.E.  
Geotechnical Engineer

Review Conducted By:



William C. Kwasny, P.E.  
Principal Engineer



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**1.0 INTRODUCTION**

Anderson Engineering of MN, LLC (AE-MN) is designing a new building at the VA Medical Center in Tomah, Wisconsin. The building will be located on the south side of G Street, and will be connected to the east side of Building 404 by means of a corridor. The new building will provide 75 beds for the TR and Substance Abuse/Post-Traumatic Stress Disorder programs. To assist with planning and design, Mr. Peter Rauma, AIA, of AE-MN authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program at the site and perform a geotechnical engineering review for the project. This report presents the results of the above services, and provides our engineering recommendations based on this data.

**2.0 SCOPE OF SERVICES**

AET's services were performed according to our proposal to AE-MN dated September 7, 2012, and authorized on October 24, 2012. The authorized scope consists of the following:

- Drill and sample five geotechnical borings to depths of 30 feet each;
- Submit recovered soil samples to our laboratory for examination and final classification by a geotechnical engineer, and preparation of boring logs; and
- Prepare the geotechnical report.

These services are intended for geotechnical purposes. The scope is not intended to explore for the presence or extent of environmental contamination in the soil and groundwater.

**3.0 PROJECT INFORMATION**

The project consists of a new three-story building that will be connected to the east side of Building 404 by means of a corridor. The new building will have about 10,000 square feet per floor and will not have a basement. The building will be of steel frame construction, with a precast plank floor system and lightweight topping. The exterior walls will be masonry on steel

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stud backup. Mr. Doug Sholl of HDR, Inc. estimated maximum column loads of 200 kips and a perimeter wall load of 1 kip per linear foot. The live floor load will probably be less than 250 pounds per square foot. According to the site survey drawing prepared by AE-MN, the existing Building 404 has a finished first floor elevation of 953.3 feet; the new building finished first floor elevation will be 2 feet lower, at about 951.3 feet.

This information represents our understanding of the proposed construction and is an integral part of our engineering review. It is important that we be contacted if there are changes from that described so that we can evaluate whether modifications to our recommendations are appropriate.

**4.0 SUBSURFACE EXPLORATION AND TESTING****4.1 Field Exploration Program**

We drilled five borings for this project on November 8 and 9, 2012. We recommended the number and depth (30 feet) of the borings, and HDR selected the boring locations, which are shown on Figure 1 in Appendix A of this report. Before we drilled, we contacted Diggers Hotline to locate public underground utilities on the site.

Our drill crew shot the surface elevations at the boring locations referenced to the finished first floor of Building 404 just inside the east door. The site survey drawing prepared by AE-MN shows this floor at elevation 953.3 feet.

We drilled the borings with a CME 55 rig, using hollow-stem augers and mud rotary techniques to advance the boreholes. We sampled the soil by the split-barrel method (ASTM D1586). Our drill crew kept field logs noting the methods of drilling and sampling, along with Standard Penetration values (N-values, “blows per foot”), preliminary soil classifications, and observed

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groundwater levels. Representative portions of the recovered samples were sealed in jars to reduce moisture loss, and submitted to our laboratory for review, testing, and final classification by a geotechnical engineer.

Upon completion of the drilling we backfilled the boreholes with bentonite chips to comply with Wisconsin Administrative Code NR 141.

**4.2 Laboratory Classification**

The laboratory classification was initiated by a geotechnical engineer examining each of the recovered soil samples to assess the major and minor components, while also noting the color, degree of saturation, and lenses or seams found in the samples. The geotechnical engineer visually-manually classified the recovered samples in accordance with the Unified Soil Classification System (USCS). The capital letters in parentheses following the written descriptions on the boring logs are the estimated group symbols based on this system. A chart describing this classification system is included in Appendix A of this report.

We grouped the soils by type into the strata shown on the boring logs. The stratification lines shown on the logs are approximate; *in-situ*, the transition between soil types may be gradual or abrupt in the horizontal and vertical directions.

We performed seven moisture content tests, three unconfined compressive strength tests (by hand penetrometer), and four gradation tests on the recovered soil samples. These test results are provided in Appendix A.

We will retain the soil samples from this program for 30 days after the date of this report. Please contact us if we should retain the samples beyond this time; otherwise the samples will be

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discarded.

## **5.0 SITE CONDITIONS**

### **5.1 Surface Observations**

The proposed building area is mostly occupied by lawn and trees, with some bituminous pavement and underground utilities. The ground surface slopes downward from west to east, with our boring elevations ranging from about 949 feet to 951 feet.

### **5.2 Subsurface Conditions**

The subsurface conditions we encountered are shown on the boring logs in Appendix A of this report. The conditions that we describe and discuss in this report are pertinent only at the boring locations and under the environment at the time of our field exploration.

We measured 6 to 18 inches of topsoil at the surface of borings B-1 through B-4, and 2 inches of asphaltic concrete at the B-5. We found fill to a depth of 4.5 feet in B-5, consisting of base course to 1.5 feet, and then mostly silty sand to sandy silt to 4.5 feet. Below the topsoil, pavement, and fill, we encountered mixed and coarse alluvium.

We found mixed alluvium, consisting of silty sand and sandy silt, to depths of 2, 3, 5, and 2 feet in borings B-1 through B-4, respectively. The mixed alluvium was loose, with N-values of 6 to 8, and unconfined compressive strengths (estimated by hand penetrometer) of 1.25 to 1.5 tons per square foot; the mixed alluvium had moisture contents of 14 to 18%

The underlying soils in each boring were coarse alluvium, consisting of sand and sand with silt. These soils were loose to dense, with N-values ranging from 6 to 32.

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**5.3 Groundwater**

We encountered groundwater at depths of 6.4 to 8.3 feet in the borings, corresponding to elevations of 942.5 to 944.1 feet. Because the coarse alluvium we encountered is relatively permeable, it is our opinion that these water levels represented the hydrostatic groundwater table on the date of drilling.

Perched groundwater can develop in the granular soils on this site in the form of waves of water infiltrating downward after heavy precipitation. This is a temporary condition, but it could impact the construction. If precipitation were to fall just prior to or during site preparation, water could also be perched on and within the mixed alluvium.

The groundwater tables on this site, perched and hydrostatic, will vary in elevation seasonally and annually depending on local amounts of precipitation, infiltration, and surface runoff. Groundwater elevations are generally lower in late winter and early spring due to the absence of surface infiltration, and tend to rise in the spring and summer.

In our opinion, the hydrostatic groundwater levels on this site could rise to such an elevation as to detrimentally affect the proposed construction, but probably not the post-construction performance of the proposed slab-on-grade building. The groundwater table could be encountered during excavation for the foundation and utilities.

**6.0 RECOMMENDATIONS****6.1 Approach Discussion**

Based on the subsurface conditions found in our borings and on our understanding of the project, it is our opinion that the proposed building can be supported on conventional footing foundations after proper site preparation has taken place. The site preparation should include removal of all

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vegetation, soils with organics, existing pavements and fill, and existing utilities, followed by placement of new compacted fill to form the building pad and excavation to bottom of foundation elevation. Details of our recommendations are presented below.

## **6.2 Building Grading**

### **6.2.1 Excavation**

Excavation for this project should remove all vegetation, soils with organics, existing pavements and fill, and existing utilities from within the building footprint and extending to at least 10 feet beyond the building perimeter.

The sidewall slopes of the excavations must comply with OSHA regulations. It is our opinion that the soils on the site should be classified as OSHA Type C, but the final decision on the OSHA type of soil should be made by the earthworks contractor's "competent person." For design and estimating purposes, we recommend that the side walls of this excavation be planned at a slope no steeper than 1.5 units horizontal to 1 unit vertical (1.5H:1V).

The earthwork contractor must be careful in excavating because mixed and coarse alluvium will be exposed as the base soils of the excavation, and these soils are susceptible to disturbance from traffic of construction equipment and workmen. We recommend the final 2 feet of soil in footing excavations be removed with a backhoe having a smooth-edge bucket (rather than a toothed bucket). The purpose of this is to avoid tearing the base soils and causing disturbance to the native soils.

We recommend that the exposed soils at the bottom of the footing excavations be surface-compacted with manually-operated compaction equipment to densify loose or disturbed areas. However, if the groundwater table is within about 3 feet of bottom of footing elevation, the

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contractor must be careful to not draw water to the surface with the equipment vibration.

**6.2.2 Fill Placement and Compaction**

If fill is needed in the building pad area, it should consist of granular soil having no more than 8% by weight passing the No. 200 sieve. A material such as WisDOT 209, Grade 1 would meet this requirement. The fill should be placed in loose lifts 8 to 10 inches thick, with each lift mechanically compacted to at least 95% of the maximum Modified Proctor dry density (ASTM D1557). We recommend that field density testing be performed as the fill is placed, not after the fill is placed.

**6.3 Foundation Design**

After the site has been prepared as described above, the building may be supported on conventional spread footing foundations. We recommend that the bottom of perimeter footings for this heated building bear at least 4 feet below final outside grade for protection from frost penetration. Foundations in unheated areas, such as entrance canopies, should bear at least 5 feet below final outside grade.

At these depths of embedment, we anticipate the footings for the new building would bear on naturally-occurring alluvium having N-values of at least 6 or on compacted granular backfill placed as described above over a suitable subgrade. We recommend using a net maximum allowable design bearing pressure of 2,500 pounds per square foot to proportion the footing sizes. The net maximum allowable design bearing pressure refers to the pressure that may be transmitted to the bearing stratum in excess of the pressure from the surrounding depth of overburden. The factor of safety with respect to soil bearing capacity for this design will be at least 3.

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We recommend that column footings and continuous wall footings have minimum widths of 4 feet and 15 inches, respectively, to avoid excessively narrow footings. With this design we estimate maximum total building settlements of up to 1 inch, and differential settlements of up to 1/2 inch, if the bearing soils are not soft, wet, disturbed, or frozen at the time of construction.

**6.4 Floor Slab Design**

The backfill recommendations provided in Section 6.2.2 also apply to trenches around wall footings and in new underslab utility trenches. This backfill should be placed in loose lifts about 4 to 6 inches thick, and should be mechanically compacted using manually-operated vibratory or impact compact equipment to at least 95% of the maximum Modified Proctor dry density.

Considering that the floor slab subgrade would be prepared during mass site grading and with trench/footing backfill placed as described above, we recommend that the structural engineer use a modulus of subgrade reaction of 200 pounds per cubic inch to design the floor slab thickness and reinforcement.

We recommend placing a vapor retarder under the floor slab in the building. The purpose of a vapor retarder is to reduce the potential for the upward migration of water vapor from the soil into and through the concrete slab. Water vapor migrating upward through the slab can damage floor covering such as tile, carpeting, wood, concrete sealers, or paint, and can contribute to excess humidity and possible microbial growth in the building. For additional recommendations on moisture and vapor protection of floor slabs, please refer to the standard sheet in Appendix A of this report entitled "Floor Slab Moisture/Vapor Protection" and Part 2, Section 302 of the ACI *Manual of Concrete Practice*. We also recommend that the specifications require the manufacturer's representative of the specified floor coverings or coatings to test the concrete floor slab before any coatings or coverings are placed and submit his approval in writing.

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The slab-on-grade should be designed and constructed following the recommendations of the Portland Cement Association and the American Concrete Institute. The slab should have construction joints/control joints at spacings recommended by the Portland Cement Association and the American Concrete Institute to mitigate, but not eliminate, slab curling and cracking. The floor slab should be cast independent of the foundation walls of the building to allow relative movement of the slabs and footings to occur without causing excessive distress to the structure.

**6.5 Exterior Slabs and Sidewalks**

Where exterior slabs and sidewalks abut the additions, we recommend that silty and clayey soils be completely subcut from below each slab/sidewalk area and replaced with non-frost susceptible (NFS) granular fill. This NFS fill subbase layer should consist of sand or a sand and gravel mix having less than 5% passing the No. 200 sieve. This fill should be compacted to at least 95% of the maximum Modified Proctor dry density.

The purpose of constructing the NFS subgrade is to reduce the potential for the characteristic heave (including differential heave) that can occur when silty and clayey soils freeze each winter. This heaving can raise the slabs to jam doors or damage the structure. The purpose of completely removing silty and clayey soils from below the exterior slabs and sidewalks is to provide a drainage pathway to the underlying highly permeable coarse alluvium; otherwise, drain pipes would have to be installed.

**7.0 SEISMIC DESIGN CONSIDERATIONS**

According to the International Building Code (2009), the Site Class is determined by the average soil properties in the top 100 feet of soil. The deepest boring for this project extended to 31.5 feet below the existing ground surface. Based on local experience and geologic conditions at the site, we do not expect the Standard Penetration resistances (N-values) to decrease below the depth of

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our borings. It is our opinion, based on IBC Table 1613.5.2, that the project site should be classified as Site Class D.

## **8.0 CONSTRUCTION CONSIDERATIONS**

### **8.1 Groundwater**

Based on the conditions found in our borings, it is our opinion that groundwater could be encountered, but this will depend on groundwater levels at the time of construction. Additionally, it is possible that zones of perched groundwater would be encountered. If water is encountered in the excavations, it should be promptly pumped out before compacted fill or concrete are placed.

The contractor should not be allowed to place fill or concrete into standing water, or over softened soils in an attempt to displace these materials. This technique can result in trapping softened soils under footings or utilities, resulting in excessive post-construction settlement, even if the softened zone is only a few inches thick.

### **8.2 Equipment Selection/Soil Disturbance**

The soil types at this site can be easily disturbed by construction equipment, especially when the soils are saturated or during freeze/thaw conditions. It is the earthwork contractor's responsibility to choose equipment and work procedures that will not disturb the subgrade soils. The contractor should also route construction traffic away from prepared foundation soils and areas of pavements and slabs, to avoid soil disturbance.

If the equipment the contractor selects causes disturbance of the soils, it is the contractor's responsibility to switch to other types of equipment and/or earthwork methods. The responsibility to properly select construction equipment to avoid disturbing the soils on this site

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lies solely with the contractor. A note to this effect should be included in the project specifications.

**8.3 Winter Construction**

Only unfrozen fill and backfill should be used, and contractors may charge extra for importing unfrozen soil or keeping soil from freezing. Placement of fill and/or foundation concrete must **not** be permitted on frozen soil, nor should bearing soils under foundations or slabs be allowed to freeze after concrete is placed, because excessive post-construction settlement could occur as the frozen soils thaw. We strongly recommend that the issue of winter construction be discussed at a pre-construction meeting, **and** that the general contractor and subcontractors be required to submit their plans for winter construction **in writing**.

**8.4 Construction Safety**

All excavations on this project must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches." This document states that excavation safety is solely the responsibility of the contractor; the decisions regarding safe slopes on the project are to be made by the contractor's "competent person." Reference to this OSHA requirement should be included in the job specifications. The responsibility to provide safe working conditions on the site, for earthwork, building construction, or any associated operations, is not borne in any manner by American Engineering Testing, Inc.

**8.5 Construction Testing**

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since soil conditions can vary among the boring locations, we recommend that the owner retain the services of a geotechnical/material engineering firm to provide observation and testing during construction, including foundations soils observations and backfill compaction

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testing. We welcome the opportunity to provide the observation and testing services for this project.

**9.0 ASTM STANDARDS**

When we refer to an ASTM Standard in this report, we mean that our services were performed in general accordance with that standard. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

**10.0 LIMITATIONS**

Within the limitations of scope, budget, and schedule, we have endeavored to perform our services according to generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, either expressed or implied, is intended. Important information regarding risk management and proper use of this report is given in Appendix B entitled "Geotechnical Report Limitations and Guidelines for Use".

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# Appendix A

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Geotechnical Field Exploration and Testing

Boring Log Notes

Unified Soil Classification System

Figure 1 – Boring Locations

Subsurface Boring Logs

Gradation Test Results

# **Appendix A**

## **Geotechnical Field Exploration and Testing**

### **AET Project No. 12-01005**

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#### **A.1 FIELD EXPLORATION**

The subsurface conditions at the site were explored by drilling and sampling five (5) standard penetration test borings. The boring locations appear on Figure 1, preceding the Subsurface Boring Logs in Appendix A.

#### **A.2 SAMPLING METHODS**

##### **A.2.1 Split-Spoon Samples (SS)**

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 or 24 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the next 12 inches is known as the standard penetration resistance or N-value.

##### **A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)**

Sample types described as “DS” or “SU” on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

##### **A.2.3 Sampling Limitations**

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders, and other large objects generally cannot be recovered from test borings, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of “topsoil” layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

#### **A.3 CLASSIFICATION METHODS**

Soil descriptions shown on the boring logs are based on the Unified Soil Classification System (USCS). The USCS is described in ASTM: D2487 and D2488. Where laboratory classification tests (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USCS, the descriptive terminology, and the symbols used on the boring logs. We have also included a chart summarizing the AASHTO soil classification system.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

#### **A.4 WATER LEVEL MEASUREMENTS**

The ground water level measurements are shown at the bottom of the boring logs. The following information appears under “Water Level Measurements” on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except that the liquid in the borehole is drilling fluid

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions, and use of borehole casing.

**Appendix A**  
**Geotechnical Field Exploration and Testing**  
**AET Project No. 12-01005**

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**A.5 TEST STANDARD LIMITATIONS**

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

**A.6 SAMPLE STORAGE**

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

## BORING LOG NOTES

### DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B, H, N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1d" is inside diameter; 2" outside diameter); unless indicated otherwise
SU:	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140-pound hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
▽:	Estimated water level based solely on sample appearance

### TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q <sub>p</sub> :	Pocket Penetrometer strength, tsf ( <u>approximate</u> )
q <sub>c</sub> :	Static cone bearing pressure, tsf
q <sub>u</sub> :	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remolded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

### STANDARD PENETRATION TEST NOTES

The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM: D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM: D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

# UNIFIED SOIL CLASSIFICATION SYSTEM

## ASTM Designations: D 2487, D2488

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Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests <sup>A</sup>				Soil Classification		Notes		
				Group Symbol	Group Name <sup>B</sup>			
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines <sup>C</sup>	$Cu \geq 4$ and $1 \leq Cc \leq 3$ <sup>E</sup>	GW	Well graded gravel <sup>F</sup>	<sup>A</sup> Based on the material passing the 3-in (75-mm) sieve.		
			$Cu < 4$ and/or $1 > Cc > 3$ <sup>E</sup>	GP	Poorly graded gravel <sup>F</sup>	<sup>B</sup> If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.		
		Gravels with Fines more than 12% fines <sup>C</sup>	Fines classify as ML or MH	GM	Silty gravel <sup>F,G,H</sup>	<sup>C</sup> Gravels with 5 to 12% fines require dual symbols:		
			Fines classify as CL or CH	GC	Clayey gravel <sup>F,G,H</sup>	GW-GM well-graded gravel with silt GW-GC well-graded gravel with clay GP-GM poorly graded gravel with silt GP-GC poorly graded gravel with clay		
		Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines <sup>D</sup>	$Cu \geq 6$ and $1 \leq Cc \leq 3$ <sup>E</sup>	SW	Well-graded sand <sup>I</sup>	<sup>D</sup> Sands with 5 to 12% fines require dual symbols:	
				$Cu < 6$ and $1 > Cc > 3$ <sup>E</sup>	SP	Poorly-graded sand <sup>I</sup>	SW-SM well-graded sand with silt SW-SC well-graded sand with clay SP-SM poorly graded sand with silt SP-SC poorly graded sand with clay	
	Sands with Fines more than 12% fines <sup>D</sup>		Fines classify as ML or MH	SM	Silty sand <sup>G,H,I</sup>			
			Fines classify as CL or CH	SC	Clayey sand <sup>G,H,I</sup>			
	Fine-Grained Soils 50% or more passes the No. 200 sieve  (see Plasticity Chart below)		Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above “A” line <sup>J</sup>	CL	Lean clay <sup>K,L,M</sup>	$E_{cu} = D_{60} / D_{10}, \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
					PI < 4 or plots below “A” line <sup>J</sup>	ML	Silt <sup>K,L,M</sup>	
		organic		Liquid limit—oven dried < 0.75 Liquid limit – not dried	OL	Organic clay <sup>K,L,M,N</sup> Organic silt <sup>K,L,M,O</sup>		
								<sup>F</sup> If soil contains ≥15% sand, add “with sand” to group name. <sup>G</sup> If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM. <sup>H</sup> If fines are organic, add “with organic fines” to group name. <sup>I</sup> If soil contains ≥15% gravel, add “with gravel” to group name. <sup>J</sup> If Atterberg limits plot is hatched area, soils is a CL-ML silty clay. <sup>K</sup> If soil contains 15 to 29% plus No. 200 add “with sand” or “with gravel”, whichever is predominant. <sup>L</sup> If soil contains ≥30% plus No. 200, predominantly sand, add “sandy” to group name. <sup>M</sup> If soil contains ≥30% plus No. 200, predominantly gravel, add “gravelly” to group name. <sup>N</sup> PI ≥ 4 and plots on or above “A” line. <sup>O</sup> PI < 4 or plots below “A” line. <sup>P</sup> PI plots on or above “A” line. <sup>Q</sup> PI plots below “A” line. <sup>R</sup> Fiber Content description shown below.
Silts and Clays Liquid limit 50 or more		inorganic		PI plots on or above “A” line	CH	Fat clay <sup>K,L,M</sup>		
				PI plots below “A” line	MH	Elastic silt <sup>K,L,M</sup>		
		organic	Liquid limit—oven dried < 0.75 Liquid limit – not dried	OH	Organic clay <sup>K,L,M,P</sup> Organic silt <sup>K,L,M,Q</sup>			
		Highly organic soil		Primarily organic matter, dark in color, and organic in odor	PT	Peat <sup>R</sup>		

**SIEVE ANALYSIS**

Percent Passing vs Particle Size in Millimeters

$C_u = \frac{D_{60}}{D_{10}} = \frac{15}{0.075} = 200$       $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = \frac{2.5^2}{0.075 \times 15} = 5.6$

**Plasticity Chart**

For classification of fine-grained soils and fine-grained fraction of coarse-grained soils.

Equation of “A”-line  
Horizontal at PI = 4 to LL = 25.5,  
then PI = 0.73 (LL-20)

Equation of “U”-line  
Vertical at LL = 16 to PI = 7,  
then PI = 0.9 (LL-8)

LIQUID LIMIT (LL)

### Notes

<sup>A</sup>Based on the material passing the 3-in (75-mm) sieve.

<sup>B</sup>If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

<sup>C</sup>Gravels with 5 to 12% fines require dual symbols:

GW-GM well-graded gravel with silt  
GW-GC well-graded gravel with clay  
GP-GM poorly graded gravel with silt  
GP-GC poorly graded gravel with clay

<sup>D</sup>Sands with 5 to 12% fines require dual symbols:

SW-SM well-graded sand with silt  
SW-SC well-graded sand with clay  
SP-SM poorly graded sand with silt  
SP-SC poorly graded sand with clay

$$F_c u = D_{60} / D_{10}, \quad C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

<sup>F</sup>If soil contains  $\geq 15\%$  sand, add "with sand" to group name.

<sup>G</sup>If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

<sup>H</sup>If fines are organic, add "with organic fines" to group name.

<sup>I</sup>If soil contains  $\geq 15\%$  gravel, add "with gravel" to group name.

<sup>J</sup>If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.

<sup>K</sup>If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.

<sup>L</sup>If soil contains  $\geq 30\%$  plus No. 200, predominantly sand, add "sandy" to group name.

<sup>M</sup>If soil contains  $\geq 30\%$  plus No. 200, predominantly gravel, add "gravelly" to group name.

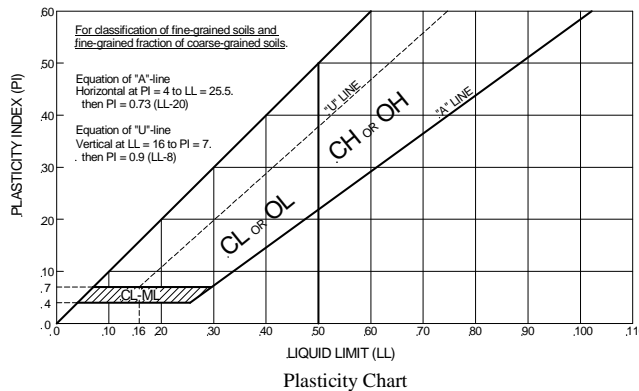
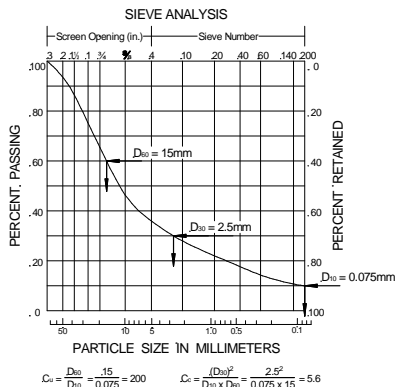
<sup>N</sup>PI  $\geq 4$  and plots on or above "A" line.

<sup>O</sup>PI < 4 or plots below "A" line.

<sup>P</sup>PI plots on or above "A" line.

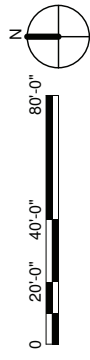
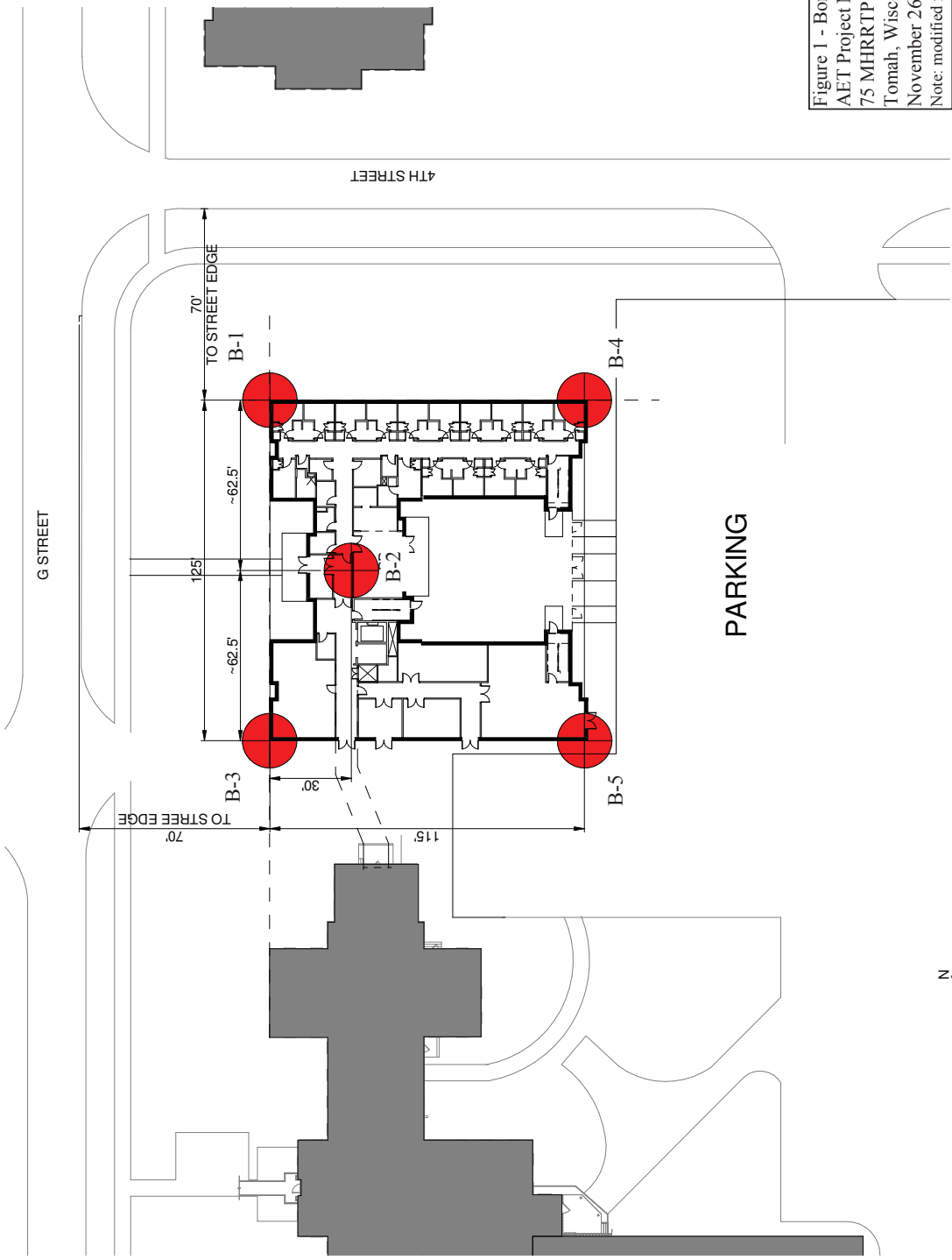
<sup>Q</sup>PI plots below "A" line.

<sup>R</sup>Fiber Content description shown below.



### ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size		Gravel Percentages		Consistency of Plastic Soils		Relative Density of Non-Plastic Soils	
Term	Particle Size	Term	Percent	Term	N-Value, BPF	Term	N-Value, BPF
Boulders	Over 12"	A Little Gravel	3% - 14%	Very Soft	less than 2	Very Loose	0 - 4
Cobbles	3" to 12"	With Gravel	15% - 29%	Soft	2 - 4	Loose	5 - 10
Gravel	#4 sieve to 3"	Gravelly	30% - 50%	Firm	5 - 8	Medium Dense	11 - 30
Sand	#200 to #4 sieve			Stiff	9 - 15	Dense	31 - 50
Fines (silt & clay)	Pass #200 sieve			Very Stiff	16 - 30	Very Dense	Greater than 50
				Hard	Greater than 30		
Moisture/Frost Condition		Layering Notes		Peat Description		Organic Description (if no lab tests)	
D (Dry):	Absence of moisture, dusty, dry to touch.	Laminations:	Layers less than 1/2" thick of differing material or color.	Term	Fiber Content (Visual Estimate)	Soils are described as <i>organic</i> , if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. <i>Slightly organic</i> used for borderline cases.	
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over "optimum").			Fibric Peat:	Greater than 67%	Root Inclusions	
W (Wet/ Waterbearing):	Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.	Lenses:	Pockets or layers greater than 1/2" thick of differing material or color.	Hemic Peat:	33 - 67%	With roots:	Judged to have sufficient quantity of roots to influence the soil properties.
F (Frozen):	Soil frozen			Sapric Peat:	Less than 33%	Trace roots:	Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.



Project Title  
VA TOMAH  
75 BED

Sheet Title  
SOIL BORING POINT DIAGRAM

Project Number VA 676-332	Reference Sheet
Project Manager	Reference Document
Date 11/01/12	Sheet Number -



# SUBSURFACE BORING LOG

AET JOB NO: **12-01005**

LOG OF BORING NO. **B-1 (p. 1 of 1)**

PROJECT: **75 MHR RTP Beds; VA Medical Center; G Street at 4th Street; Tomah, Wisconsin**

DEPTH IN FEET	SURFACE ELEVATION: <b>949.4</b> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	Qp	LL	PL	%-#200
1	1.5' - TOPSOIL: Organic SANDY SILT, dark brown, moist, loose (OL)	TOPSOIL	6	M	SS	16					
2	SILTY SAND to SANDY SILT, dark brown, moist, loose (SM to ML)	MIXED ALLUVIUM COARSE ALLUVIUM					14	1.5			
3	POORLY GRADED SAND WITH SILT and a little fine gravel, fine to medium grained, light brown, moist, loose (SP-SM)		8	M	SS	16					
4											
5	POORLY GRADED SAND, fine to medium grained, light brown, moist to waterbearing at 6.4 feet, loose to medium dense (SP)		8	M	SS	14					1
6											
7											
8			9	W	SS	15					
9											
10			15	W	SS	15					
11											
12											
13			17	W	SS	15					
14											
15			18	W	SS	14					
16											
17											
18			22	W	SS	14					
19											
20			19	W	SS	14					
21											
22											
23											
24											
25			26	W	SS	12					
26											
27											
28											
29											
30											
31			30	W	SS	12					
END OF BORING											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0 - 9'	3.25" HSA								
9' - 29.5'	RD w/DM	11/8/12	12:30	9.0	7.0	6.5	None	6.4	
BORING COMPLETED: 11/8/12									
DR: MD LG: NW Rig: 5									

































# SUBSURFACE BORING LOG

AET JOB NO: **12-01005**

LOG OF BORING NO. **B-2 (p. 1 of 1)**

PROJECT: **75 MHR RTP Beds; VA Medical Center; G Street at 4th Street; Tomah, Wisconsin**

DEPTH IN FEET	SURFACE ELEVATION: <u>950.5</u>		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
	MATERIAL DESCRIPTION							WC	Qp	LL	PL	%-#200	
1	6" - TOPSOIL: Organic SANDY SILT, dark brown, moist, loose (OL)		TOPSOIL	6	M		SS	18	14				
2	SILTY SAND, fine to medium grained, dark brown, moist, loose (SM)		MIXED ALLUVIUM										
3	POORLY GRADED SAND, fine to medium grained, light brown to organish brown, moist to waterbearing at 6.8 feet, loose to medium dense (SP)		COARSE ALLUVIUM	6	M		SS	18					
4													
5													
6				15	M		SS	18	1				
7													
8				12	W		SS	18					
9													
10				21	W		SS	14					
11													
12													
13				18	W		SS	13					
14													
15				9	W		SS	12					
16													
17													
18				10	W		SS	13					
19													
20				21	W		SS	14					
21													
22													
23													
24													
25	25	W		SS	17								
26													
27													
28													
29													
30													
31													
	END OF BORING												

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0 - 9'	3.25" HSA								
9' - 29.5'	RD w/DM	11/8/12	2:15	9.0	7.0	6.9	None	6.8	
BORING COMPLETED: 11/8/12									
DR: MD LG: NW Rig: 5									



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# SUBSURFACE BORING LOG

AET JOB NO: <b>12-01005</b>					LOG OF BORING NO. <b>B-3 (p. 1 of 1)</b>									
PROJECT: <b>75 MHR RTP Beds; VA Medical Center; G Street at 4th Street; Tomah, Wisconsin</b>														
DEPTH IN FEET	SURFACE ELEVATION: <b>950.8</b>		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
	MATERIAL DESCRIPTION							WC	Qp	LL	PL	%-#200		
1	8" - TOPSOIL: Organic SANDY SILT, dark brown, moist, loose (OL)		TOPSOIL MIXED ALLUVIUM	8	M	SS	17	14	1.5					
2	SILTY SAND to SANDY SILT, a little fine gravel, dark brown, moist, loose (SM to ML)			6	M	SS	16	14						50
3	SILTY SAND to SANDY SILT, fine grained, brown, moist, loose (SM to ML)													
4			COARSE ALLUVIUM	9	M	SS	18							
5	POORLY GRADED SAND, fine to medium grained, light brown, moist to waterbearing at 8.3 feet, loose to medium dense (SP)			10	W	SS	16							
6				12	W	SS	20							
7				12	W	SS	13							
8				17	W	SS	13							
9				15	W	SS	14							
10				20	W	SS	14							
11				20	W	SS	15							
12				24	W	SS	14							
13														
14														
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16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
END OF BORING														

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0 - 9'	3.25" HSA								
9' - 29.5'	RD w/DM	11/8/12	3:50	11.5	9.5	8.6	None	8.3	
BORING COMPLETED: 11/8/12									
DR: MD LG: NW Rig: 5									



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TESTING, INC.

# SUBSURFACE BORING LOG

AET JOB NO: **12-01005**

LOG OF BORING NO. **B-4 (p. 1 of 1)**

PROJECT: **75 MHR RTP Beds; VA Medical Center; G Street at 4th Street; Tomah, Wisconsin**

DEPTH IN FEET	SURFACE ELEVATION: <b>950.3</b> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	Qp	LL	PL	%-#200
1	12" - TOPSOIL: Organic SANDY SILT, dark brown, moist, loose (OL)	TOPSOIL	8	M	SS	17	17	1.5			
2	Sandy SILT, dark brown, moist, loose (ML)	MIXED ALLUVIUM									
3	POORLY GRADED SAND, fine to medium grained, light brown, moist to waterbearing at 6.8 feet, loose to dense (SP)	COARSE ALLUVIUM	8	M	SS	17					
4											
5			12	M	SS	16					
6											
7											
8			11	W	SS	16					
9											
10			12	W	SS	14					
11											
12											
13			10	W	SS	14					
14											
15			12	W	SS	13					
16											
17											
18			8	W	SS	14					
19											
20			12	W	SS	14					
21											
22											
23											
24											
25											
26			17	W	SS	13					
27											
28											
29											
30											
31			32	W	SS	14					
END OF BORING											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0 - 9'	3.25" HSA								
9' - 29.5'	RD w/DM	11/9/12	7:47	9.0	7.0	6.9	None	6.8	
BORING COMPLETED: 11/9/12									
DR: MD LG: NW Rig: 5									



# SUBSURFACE BORING LOG

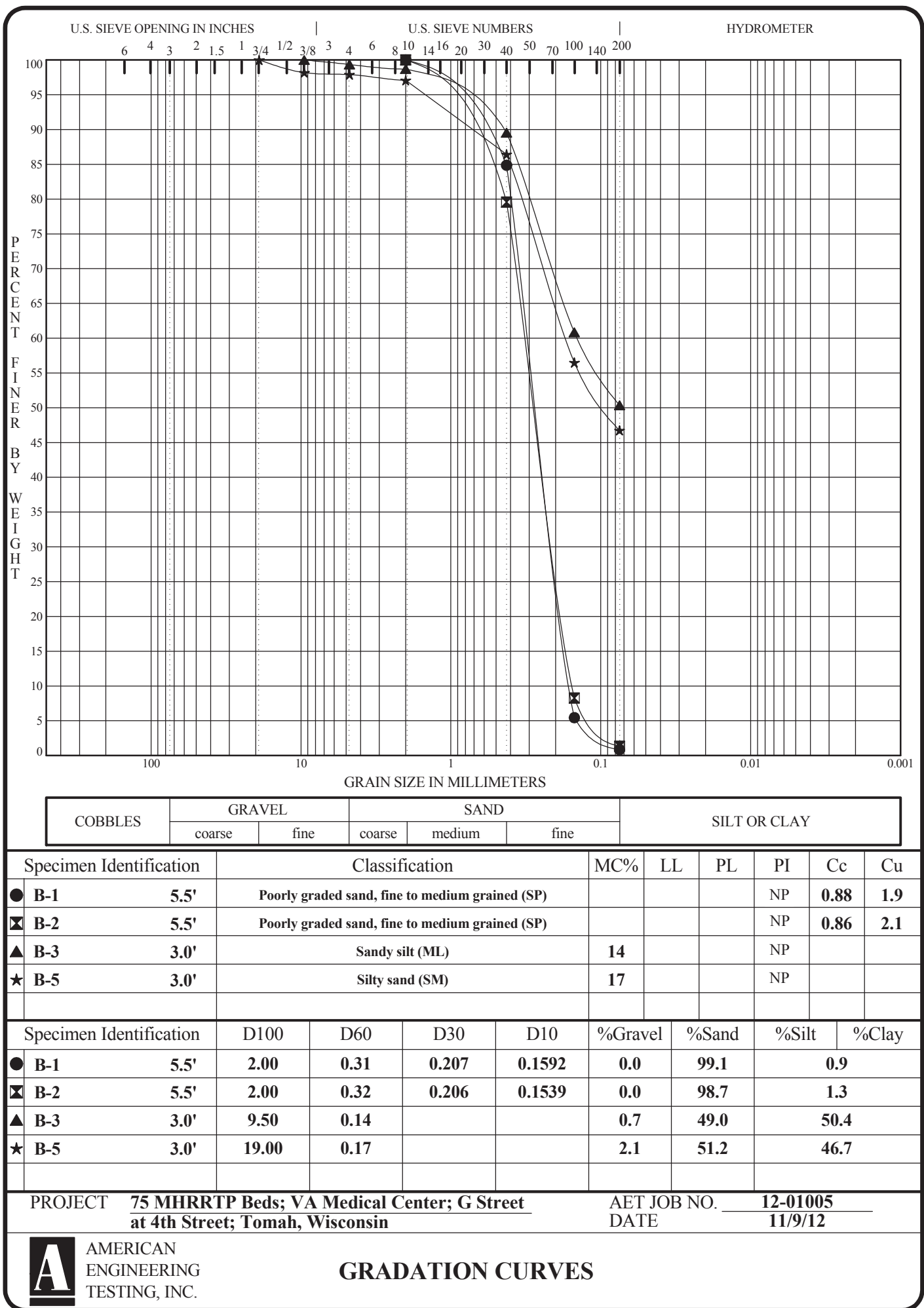
AET JOB NO: **12-01005**

LOG OF BORING NO. **B-5 (p. 1 of 1)**

PROJECT: **75 MHR RTP Beds; VA Medical Center; G Street at 4th Street; Tomah, Wisconsin**

DEPTH IN FEET	SURFACE ELEVATION: 951.2		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
	MATERIAL DESCRIPTION							WC	Qp	LL	PL	%-#200
1	2" - ASPHALTIC CONCRETE		FILL	15	M	SS	16	18				47
2	BASE COURSE: Silty sand with crushed limestone gravel, fine to coarse grained, light brown, moist, medium dense											
3	FILL, mostly silty sand to sandy silt, a little gravel, and trace organic fibers, dark brown, moist											
4	POORLY GRADED SAND, fine to medium grained, light brown, moist to waterbearing at 7.1 feet, loose to medium dense (SP)		COARSE ALLUVIUM	5	M	SS	18	17				
5												
6				12	M	SS	18					
7												
8				9	W	SS	16					
9												
10				16	W	SS	14					
11												
12												
13				18	W	SS	14					
14												
15				15	W	SS	14					
16												
17												
18				13	W	SS	14					
19												
20				18	W	SS	14					
21												
22												
23												
24												
25				26	W	SS	16					
26												
27												
28												
29												
30				30	W	SS	16					
31												
END OF BORING												

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0 - 9'	3.25" HSA								
9' - 29.5'	RD w/DM	11/9/12	9:15	9.0	7.0	7.1	None	7.1	
BORING COMPLETED: 11/9/12									
DR: MD LG: NW Rig: 5									



**Report of Geotechnical Exploration and Review**

Proposed New Building; 75 MHR RTP Beds; VA Medical Center

G Street at 4<sup>th</sup> Street; Tomah, Wisconsin

November 26, 2012

AET Project No. 12-01005

AMERICAN  
ENGINEERING  
TESTING, INC.

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## **Appendix B**

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AET Project No. 12-01005

Geotechnical Report Limitations and Guidelines for Use

## **Appendix B**

### **Geotechnical Report Limitations and Guidelines for Use**

#### **AET Project No. 12-01005**

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#### **B.1 REFERENCE**

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by ASFE<sup>1</sup>, of which, we are a member firm.

#### **B.2 RISK MANAGEMENT INFORMATION**

##### **B.2.1 Geotechnical Services are Performed for Specific Purposes, Persons, and Projects**

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. And no one, not even you, should apply the report for any purpose or project except the one originally contemplated.

##### **B.2.2 Read the Full Report**

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

##### **B.2.3 A Geotechnical Engineering Report is Based on A Unique Set of Project-Specific Factors**

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typically factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, always inform your geotechnical engineer of project changes, even minor ones, and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

##### **B.2.4 Subsurface Conditions Can Change**

A geotechnical engineering report is based on conditions that existed at the time the study was performed. Do not rely on a geotechnical engineering report whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

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<sup>1</sup> ASFE, 8811 Colesville Road/Suite G106, Silver Spring, MD 20910  
Telephone: 301/565-2954: [www.asfe.org](http://www.asfe.org)

## **Appendix B**

### **Geotechnical Report Limitations and Guidelines for Use**

#### **AET Project No. 12-01005**

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#### **B.2.5 Most Geotechnical Findings Are Professional Opinions**

Site exploration identified subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

#### **B.2.6 A Report's Recommendations Are Not Final**

Do not overrely on the construction recommendations included in your report. Those recommendations are not final, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

#### **B.2.7 A Geotechnical Engineering Report Is Subject to Misinterpretation**

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

#### **B.2.8 Do Not Redraw the Engineer's Logs**

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognizes that separating logs from the report can elevate risk.

#### **B.2.9 Give Contractors a Complete Report and Guidance**

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In the letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

#### **B.2.10 Read Responsibility Provisions Closely**

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their report. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

#### **B.2.11 Geoenvironmental Concerns Are Not Covered**

The equipment, techniques, and personnel used to perform a geoenvironmental study differ significantly from those used to perform a geotechnical study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated environmental problems have led to numerous project failures. If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. Do not rely on an environmental report prepared for someone else.